Notice of Allowability	Application No.	Applicant(s)	
	09/785,999	UGLOW ET AL.	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE 11/10/05*.

2. ☒ The allowed claim(s) is/are *1,4-9 and 33-35*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 2/6/01; 6/10/02; 12/2/02; 7/19/04
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Carl Whitehead

CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/11/05 has been entered.

Allowable Subject Matter

2. Claims 1, 4-9, and 33-35 are allowed.

3. The following is an examiner's statement of reasons for allowance:

The primary reason for allowance is the specific, closed-form language of step (d) of claim 1, wherein forming the inter-metal dielectric structure consists of the sequential steps of depositing an inorganic dielectric layer directly on a barrier layer; forming a carbon-doped oxide layer directly on and in contact with the inorganic dielectric layer; forming a trench in the carbon-doped oxide layer; and finally forming a via in the inorganic dielectric layer from within the trench. This language specifically requires a lamination of a barrier layer, an inorganic dielectric layer, and a carbon-doped oxide layer (i.e. a partially organic film) with no intervening or additional layers when forming the wiring trench, as well as requiring etching of the trench before etching of the via.

The prior art of record teaches many of the elements in claim 1, but there is insufficient motivation to combine such elements and arrive at the specifically claimed method steps. For example, US 6,197,696 to Aoi and US 6,413,583 to Moghadan et al. disclose the use of carbon-doped silicon oxide as an inter-metal dielectric layer. Aoi further teaches most of the claimed process steps, but only teaches laminations of a barrier film/inorganic film/organic film (modified embodiment 3); a barrier film/carbon-doped oxide film/organic film (embodiment 3), or a structure having a barrier/inorganic film/thin carbon-doped oxide film/inorganic film, where the inorganic films support both the trench and via (embodiment 4). Aoi does not in any way indicate or suggest the claimed layer structure. Since the layer structure set forth in the claims provides the specific advantage of preventing barrier etch-through (and hence the exposure of the underlying wiring film) when etching the carbon-doped oxide layer, and since the specific layer structure is not suggested by the prior art, it is the Examiner's opinion that the specific method steps present in step (d) of claim 1 would not have been obvious or fairly suggested to a person having ordinary skill in the art.

The Examiner further notes that the claim language requires the etching of the trench in the upper, carbon-doped oxide film before the etching of the via in the lower inorganic film. Although trench-first methods of forming a dual-damascene structure are well known in the art (see, for example, US 6,340,435 to Bjorkman et al.), and hence, would normally be considered an obvious modification of the via-first methods in Aoi based on art-recognized suitability of a known-process, the Examiner considers such a modification unobvious in combination with the specifically claimed layer structure. By etching the trench in the carbon-doped oxide first, one can completely isolate the barrier layer, which tends to have a poor etch selectivity with respect

to the carbon-doped oxide layer, from the c-oxide layer etchants. Since the trench-first method as applied to the claimed structure further prevents etching of the barrier layer and exposure of the underlying metal layer, and since the prior art provides no suggestion that such an advantage might be obtained through a trench-first process, the claimed combination is considered critical and unobvious to a person having ordinary skill in the art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd